# PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

## PCT

### NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|---|---|
| **Date of mailing** (day/month/year)<br>23 February 2001 (23.02.01) | |
| **International application No.**<br>PCT/SE00/01099 | **Applicant's or agent's file reference**<br>KN 8699 WO |
| **International filing date** (day/month/year)<br>26 May 2000 (26.05.00) | **Priority date** (day/month/year)<br>27 May 1999 (27.05.99) |
| **Applicant**<br>ASPLUND, Gunnar et al | |

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

22 December 2000 (22.12.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| **The International Bureau of WIPO**<br>**34, chemin des Colombettes**<br>**1211 Geneva 20, Switzerland** | Authorized officer<br>R. E. Stoffel |
| Facsimile No.: (41-22) 740.14.35 | Telephone No.: (41-22) 338.83.38 |

# PATENT COOPERATION TREATY

## PCT

### NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

RECEIVED
MAR 11 2002
TECHNOLOGY CENTER 2800

To:
LARSSON, Håkan
ABB Group Services Center AB
Legal & Compliance/Intellectual Property
S-721 78 Västerås
SUÈDE

**Date of mailing** (day/month/year)
31 January 2002 (31.01.02)

**Applicant's or agent's file reference**
KN 8699 WO

**IMPORTANT NOTIFICATION**

**International application No.**
PCT/SE00/01099

**International filing date** (day/month/year)
26 May 2000 (26.05.00)

**1.** The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [X] the agent [ ] the common representative

Name and Address
LARSSON, Håkan
ABB AB
Patent
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Sweden

State of Nationality:
State of Residence:
Telephone No.: +46 21 32 30 00
Facsimile No.: +46 21 18 13 86
Teleprinter No.:

**2.** The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address
LARSSON, Håkan
ABB Group Services Center AB
Legal & Compliance/Intellectual Property
S-721 78 Västerås
Sweden

State of Nationality:
State of Residence:
Telephone No.: +46 21 32 30 00
Facsimile No.: +46 21 18 13 86
Teleprinter No.:

**3.** Further observations, if necessary:

**4.** A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

**The International Bureau of WIPO**
**34, chemin des Colombettes**
**1211 Geneva 20, Switzerland**

Facsimile No.: (41-22) 740.14.35

Authorized officer
N. Wagner

Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

004633973

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference KN 8699 WO | FOR FURTHER ACTION | see Notification of Transmittal of International Search Report (Form PCT/ISA 220) as well as, where applicable, item 5 below. |
|---|---|---|
| International application No. PCT/SE 00/01099 | International filing date *(day month year)* 26 May 2000 | (Earliest) Priority Date *(day month year)* 27 May 1999 |
| Applicant ABB AB et al | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (See Box I).

2. [ ] **Unity of invention is lacking** (See Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] transcribed by this Authority.

4. With regard to the **title**,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:
   Figure No. 1
   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01099

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H01H 33/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H01B, H01H, H02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | DE 19719739 A1 (KAISER KABEL GMBH), 12 November 1998 (12.11.98), column 5, line 59 - column 6, line 41, figures 5,6 | 1-8 |
| A | GB 2125637 A (RAYCHEM CORPORATION), 7 March 1984 (07.03.84), page 4, line 90 - line 130, figure 3 | 1-8 |
| A | US 3559141 A (S.G. HARDY), 26 January 1971 (26.01.71), column 3, line 31 - column 5, line 16, figure 1 | 1-8 |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" erlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 30 August 2000 | 07 -09- 2000 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>Bertil Nordenberg/MN<br>Telephone No. +46 8 782 25 00 |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

08/05/00

International application No.
PCT/SE 00/01099

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE 19719739 A1 | 12/11/98 | NONE | |
| GB 2125637 A | 07/03/84 | AT 43751 T | 15/06/89 |
| | | CA 1216015 A | 30/12/86 |
| | | DE 3380000 D | 00/00/00 |
| | | EP 0111553 A,B | 27/06/84 |
| | | WO 8400078 A | 05/01/84 |
| US 3559141 A | 26/01/71 | NONE | |

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| Applicant's or agent's file reference KN 8699 WO | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
|---|---|---|
| International application No. PCT/SE00/01099 | International filing date *(day/month/year)* 26.05.2000 | Priority date *(day/month/year)* 27.05.1999 |
| International Patent Classification (IPC) or national classification and IPC7 H 01 H 33/02 | | |
| Applicant ABB AB et al | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 22.12.2000 | 28.08.2001 |
| Name and mailing address of the IPEA/SE<br>Patent- och registreringsverket<br>Box 5055<br>S-102 42 STOCKHOLM<br>Telex 17978 PATOREG-S<br>Facsimile No. 08-667 72 88 | Authorized officer<br>Bertil Nordenberg/MN<br>Telephone No. 08-782 25 00 |

Form PCT/IPEA/409 (cover sheet) (January 1998)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE00/01099

## I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-3,5,7,8 , as originally filed
pages 4,6 , filed with the demand
pages _____ , filed with the letter of _____

☒ the claims:
pages 9-10 , as originally filed
pages _____ , as amended (together with any statement) under article 19
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☒ the drawings:
pages 1-3 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language English which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 1-8 | YES |
| | Claims | | NO |
| Inventive step (IS) | Claims | 1-8 | YES |
| | Claims | | NO |
| Industrial applicability (IA) | Claims | 1-8 | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1 DE 19719739 A1
D2 GB 2125637 A
D3 US 3559141 A

D1 (see column 5, line 59 - column 6, line 41, figures 5 and 6) discloses a switching device comprising a switching means for making or breaking a current path between a first cable and a second cable. The cables have an inner semiconductive layer surrounding a conductor, an electrically insulating layer surrounding the inner layer and an outer semiconductive layer surrounding the electrically insulating layer. The switching means, comprising a controllable semiconductor, has also a surrounding semiconductive layer, a surrounding electrically insulating layer and an outer semiconductive layer surrounding the electrically insulating layer. Because of the losses in the controllable semiconductor it cannot, however, be used as, for instance, an on-load tap changer (as the mechanical switching means according to the invention).

D2 (see page 4, line 90 - line 130, figure 3) describes only a fuse, surrounded by a number of conductive and insulating layers. D3 shows a similar arrangement.

None of the citations, or any relevant combination thereof, thus anticipates the present invention, stated in claims 1 - 8. The invention is thus considered to be novel, involve an inventive step and comprise industrial applicability.

cables, and the shield corresponds to the outer layers of the cables.

The field-controlling body preferably has a potential which essentially corresponds to the potential of the cable conductors, and the shield preferably has a potential which essentially corresponds to the potential of the outer layer of the cables.

According to one preferred embodiment of the invention, the field-controlling body is electrically connected to at least one of the inner layers of the cables.

According to another embodiment of the invention, the shield is electrically connected to at least one of the outer layers of the cables.

The insulating body assumes the voltage difference between the field-controlling body and the shield. The voltage difference between the cables in the open position is assumed in the switching means, for example in air gaps between movable contact members or by power semiconductor devices.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be explained in greater detail with reference to the accompanying drawings, wherein

Figure 1 shows a first embodiment of the invention,

Figure 2 shows a second embodiment of the invention, and

Figures 3 and 4 show a third embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a first embodiment of a switching device 1 according to the invention, wherein the switching device 1

The switching device 1 has a field-controlling means in the form of an inner semiconductive layer 21 which surrounds the switching means. At one end, the layer 21 makes contact, via an inner semiconductive connecting layer 22 in the joint means 3, with the inner semiconductive layer 7 of the first cable 2. At its other end, the semiconductive layer 21 makes contact, via an inner semiconductive connecting layer 23 in the second joint means 5, with the inner semiconductive layer 11 of the second cable 4. The layer 21 surrounds the contact member 17 and is in electrical contact therewith along the whole of its length. The layer 21 also surrounds the contact member 14 but is electrically connected thereto along part of its length only, whereupon the inner surface of the layer 21 deviates from the surface of the contact member 14 and forms the radial limiting surface of the switching chamber 15.

Outside the layer 21, and making good contact therewith, an electrically insulating body 24 is arranged, which surrounds the layer 21 along substantially the whole of its length. The ends of the body 24 make contact with electrically insulating bodies 25 and 26 in the joint units 3 and 5.

Further, the switching device 1 has a shield, arranged outside the body 24, in the form of a semiconductive layer 27 which at one end, via a semiconductive connecting layer 28 in the first joint means 3, makes contact with the outer semiconductive layer 9 of the first conductor 2. At its other end, the layer 27 makes contact, via a second semiconductive connecting layer 29 in the second joint means 5, with the outer semiconductive layer 13 of the second conductor 4.

The layers 7, 22, 21, 23 and 11 together form a continuous inner semiconductive layer which surrounds all the current-carrying members of the switching device 1 and the cables 2 and 4. Surrounding this continuous layer, the bodies 8, 25, 24, 26 and 12 form a continuous electrically insulating body, and surrounding this continuous body, the layers 9,

RECORD COPY

# PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No PCT/SE 00 / 0 1 0 9 9

International Filing Date 26 -05- 2000

The Swedish Patent Office
PCT International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* KN 8699 WO

**Box No. I TITLE OF INVENTION**

ELKOPPLARE/ELECTRIC SWITCHING DEVICE

**Box No. II APPLICANT**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

ABB AB
S-721 83 Västerås
Sweden

☐ This person is also inventor.

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Facsimile No
+46 21 13 41 12

Teleprinter No

State *(that is, country)* of nationality:
SE

State *(that is, country)* of residence:
SE

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

PC/SE1 Gunnar ASPLUND
Vasagatan 15
S-771 32 Ludvika
Sweden

This person is:
☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:
SE

State *(that is, country)* of residence:
SE

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

PC/SE2 ☒ Further applicants and/or (further) inventors are indicated on a continuation sheet

**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is ~~hereby~~ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

LARSSON, Håkan; BENGTSSON, Mats; JANSEN Helma
ABB AB
Patent
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Teleprinter No

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent

**Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

***If none of the following sub-boxes is used, this sheet should not be included in the request.***

Name and address *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

RO/SE

Tommy LARSSON
Kolhusvägen 8,
SE-771 90 Ludvika
Sweden

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: SE

State *(that is, country)* of residence: SE

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

RO/SE

Lars JONSSON
Annundsgatan 10,
SE-725 51 Västerås
Sweden

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: SE

State *(that is, country)* of residence: SE

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

RO/SE

Lars-Olof SVEDJEHED,
Hovrättsgatan 10
SE-90325 UMEÅ
Sweden

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: SE

State *(that is, country)* of residence: SE

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

☐ Further applicants and or (further) inventors are indicated on another continuation sheet.

**Box No.V DESIGNATION OF STATES**

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes, at least one must be marked)*

**Regional Patent**

☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **TZ** United Republic of Tanzania, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

**National Patent** *(if other kind of protection or treatment desired, specify on dotted line)*

☒ **AE** United Arab Emirates
☒ **AL** Albania
☒ **AM** Armenia
☒ **AT** Austria ..... Patent and utility model
☒ **AU** Australia
☒ **AZ** Azerbaijan
☒ **BA** Bosnia and Herzegovina
☒ **BB** Barbados
☒ **BG** Bulgaria
☒ **BR** Brazil
☒ **BY** Belarus
☒ **CA** Canada
☒ **CH and LI** Switzerland and Liechtenstein
☒ **CN** China
☒ **CR** Costa Rica
☒ **CU** Cuba
☒ **CZ** Czech Republic ..... Patent and utility model
☒ **DE** Germany ..... Patent and utility model
☒ **DK** Denmark ..... Patent and utility model
☒ **DM** Dominica
☒ **EE** Estonia ..... Patent and utility model
☒ **ES** Spain
☒ **FI** Finland ..... Patent and utility model
☒ **GB** United Kingdom
☒ **GD** Grenada
☒ **GE** Georgia
☒ **GH** Ghana
☒ **GM** Gambia
☒ **HR** Croatia
☒ **HU** Hungary
☒ **ID** Indonesia
☒ **IL** Israel
☒ **IN** India
☒ **IS** Iceland
☒ **JP** Japan
☒ **KE** Kenya
☒ **KG** Kyrgyzstan
☒ **KP** Democratic People's Republic of Korea
☒ **KR** Republic of Korea
☒ **KZ** Kazakhstan
☒ **LC** Saint Lucia
☒ **LK** Sri Lanka
☒ **LR** Liberia
☒ **LS** Lesotho
☒ **LT** Lithuania
☒ **LU** Luxembourg
☒ **LV** Latvia
☒ **MA** Morocco
☒ **MD** Republic of Moldova
☒ **MG** Madagascar
☒ **MK** The former Yugoslav Republic of Macedonia
☒ **MN** Mongolia
☒ **MW** Malawi
☒ **MX** Mexico
☒ **NO** Norway
☒ **NZ** New Zealand
☒ **PL** Poland
☒ **PT** Portugal
☒ **RO** Romania
☒ **RU** Russian Federation
☒ **SD** Sudan
☒ **SE** Sweden
☒ **SG** Singapore
☒ **SI** Slovenia
☒ **SK** Slovakia ..... Patent and utility model
☒ **SL** Sierra Leone
☒ **TJ** Tajikistan
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PCT/SE00/01099
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**Box No. VI PRIORITY CLAIM** ☐ Further priority claims are indicated in the Supplemental Box

| Filing date of earlier application (day month year) | Number of earlier application | Where earlier application is: national application country | regional application * regional Office | international application receiving Office |
|---|---|---|---|---|
| item (1) 27 May 1999 | 9901985-3 | Sweden | | |
| item (2) | | | | |
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**Box No. VII INTERNATIONAL SEARCHING AUTHORITY**

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| 27 May 1999 | SE99/00753 | SE |

**Box No. VIII CHECK LIST; LANGUAGE OF FILING**

This international application contains the following **number of sheets**:

| | |
|---|---|
| request | 4 ✓ |
| description (excluding sequence listing part) | 8 ✓ |
| claims | 2 ✓ |
| abstract | 1 ✓ |
| drawings | 3 ✓ |
| sequence listing part of description | |
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1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
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**Figure of the drawings** which should accompany the abstract: 1

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**Box No. IX SIGNATURE OF APPLICANT OR AGENT**

*Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).*

Västerås, Sweden 26 May 2000

ABB AB
by Håkan Larsson

(Helma Jansen)

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1. Date of actual receipt of the purported international application: 26-05-2000
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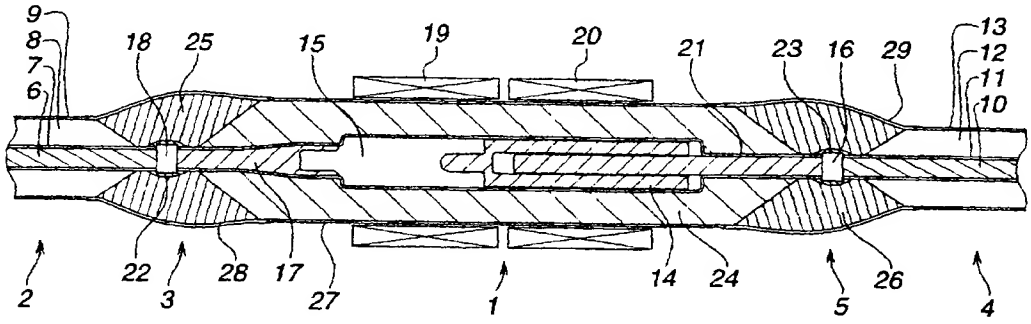
(54) **Title:** ELECTRIC SWITCHING DEVICE




(57) **Abstract:** The invention relates to a switching device (1) comprising a switching means with two contact members arranged movably in relation to each other for making or breaking a current path between two cables with an electric conductor (6, 10), an inner semiconductive layer (7, 11) surrounding the conductor, an electrically insulating solid cable body (8, 12) surrounding the inner layer, and an outer semiconductive layer (9, 13) surrounding the cable body. The switching device comprises a field-controlling means surrounding the switching means and comprising at least one conductive or semiconductive field-controlling body (21) connected to a first potential, an electrically insulating solid body (24) surrounding the field-controlling means, and a conductive or semiconductive shield (27) surrounding the insulating solid body (24) connected to a second potential. According to one embodiment of the invention, the field-controlling body (21) is electrically connected to at least one of the inner semiconductive layers (7, 11) of the cables. According to another embodiment of the invention, the shield (27) is electrically connected to at least one of the outer semiconductive layers (9, 13) of the cables.

WO 00/74094 A1

# Elkopplare

## TEKNISKT OMRÅDE

Föreliggande uppfinning avser en elkopplare av det i ingressen till det oberoende kravet 1 angivna slaget. Speciellt avser uppfinningen en lastkopplare eller en omkopplare avsedd att användas i lindningskopplare för spänningar överstigande 1 kilovolt.

## TEKNIKENS STÅNDPUNKT

I ett elkraftsystem är det önskvärt med spänningsreglering för att upprätthålla spänningen i systemet. Normalt åstadkoms spänningsreglering genom att ändra omsättningen i transformatorer i systemet. En reglerbar transformator har för detta ändamål en eller ett flertal reglerlindningar som med hjälp av lindningskopplare kopplas till eller från transformatorns primär- eller sekundärlindning. I princip finns det två typer av lindningskopplare, nämligen lindningskopplare av brytväljartyp eller lindningskopplare av lastkopplartyp. I en lindningskopplare av lastkopplartyp bryts effekten med en särskild elkopplare, sk lastkopplare, och val av reglerlindning sker med en separat elkopplare, sk omkopplare. I en lindningskopplare av brytväljartyp sker val av reglerlindning och effektbrytning vid samma manöver och i samma komponent, den sk brytväljarpolen, i vilken både lastkopplingsfunktionen och omkopplingsfunktionen är integrerad. Lindningskopplare finns i mekaniska utföranden, där omkopplings- och lastkopplings-funktionen utförs med en elkopplare som sluter och öppnar

strömbanor medelst rörliga kontaktparter manövrerade av ett manöverdon. Lindningskopplare finns också i helt elektriska utföranden, där omkopplings- och lastkopplingsfunktionen utförs med en halvledarelkopplare som sluter och öppnar strömbanor genom styrning av ledningsförmågan hos halvledare i elkopplaren.

Genom den publicerade PCT-ansökningen SE97/00875 är det känt en transformator med lindningar bestående av kabel med en elektriskt ledande ledare, ett ledaren omslutande halvledande inre skikt, en det inre skiktet omgivande elektriskt isolerande kabelkropp och ett kabelkroppen omgivande halvledande yttre skikt. Det inre skiktet är i elektrisk kontakt med ledaren och har samma potential som denna. Det yttre skiktets potential är kontrollerbar och sätts normalt till noll genom att det yttre skiktet jordas. En sådana lindning har den egenskapen att den i kabelkroppen mellan det inre och det yttre skiktet innesluter det elektriska fält som omger kabelns ledare. Eftersom det yttre skiktet har konstant potential behöver inte närliggande lindningsvarv isoleras från varandra. Om det yttre skiktets potential dessutom är ansluten till jord, behöver inte lindningarna isoleras från transformatorkärnan och transformatorn kan verka utan elektriskt isolerande transformatorolja, vilket ger en rad tekniska och miljömässiga fördelar.

Vid användning av en konventionell lindningskopplare för reglering av en kabellindad transformator av den ovan beskrivna typen, måste det inre skiktet, kabelkroppen och det yttre skiktet hos reglerlindningarnas kablar brytas vid anslutningen till lindningskopplaren. Den fältinneslutande effekten går därmed förlorad tillsammans med många av den kabellindade transformatorns fördelar. Vid kabeländarna måste dyra kabelavslutningar användas, och i lindningskopplaren krävs isolerande olja eller stora luftavstånd för att förhindra elektriska överslag.

REDOGÖRELSE FÖR UPPFINNINGEN

Ändamålet med uppfinningen är att frambringa en fältinneslutande elkopplare innefattande en kopplingsinrättning för att sluta eller bryta en strömbana mellan en första kabel och minst en andra kabel, vilka kablar har en elektrisk ledare, ett inre halvledande skikt omslutande ledaren, en elektriskt isolerande kabelkropp omslutande det inre skiktet och ett yttre halvledande skikt omslutande kabelkroppen.

Detta ändamål uppnås enligt uppfinningen med en ny typ av elkopplare enligt de i det oberoende kravets 1 kännetecknande del angivna särdragen.

Elkopplaren enligt uppfinningen innefattar:

- en fältstyrande inrättning omslutande kopplingsinrättningen innefattande minst en ledande eller halvledande fältstyrande kropp ansluten till en första potential,
- en elektriskt isolerande fast kropp omslutande den fältstyrande inrättningen,
- en ledande eller halvledande skärm omslutande kroppen ansluten till en andra potential, och
- minst två kontaktparter rörligt anordnade i förhållande till varandra, där den ena kontaktparten är elektriskt ansluten till den första kabelns ledare och den andra kontaktparten är elektriskt ansluten till den andra kabelns ledare, vilka kontakter är manövrerbara med ett manöverdon mellan ett slutet läge och ett öppet läge.

Med att den fältstyrande kroppen och skärmen är ledande eller halvledande, avses här att de i rumstemperatur har en elektrisk resistivitet mindre än 10000 ohmmeter.

Med avseende på den fältinneslutande effekten, motsvarar den fältstyrande inrättningen kablarnas inre skikt och fungerar i elkopplaren i praktiken som en fortsättning på dessa. På samma

sätt motsvarar den isolerande kroppen kablarnas kabelkroppar, och skärmen motsvarar kablarnas yttre skikt.

Den fältstyrande kroppen har företrädesvis en potential som väsentligen överensstämmer med kabelledarnas potential, och skärmen har företrädesvis en potential som väsentligen överensstämmer med potentialen hos kablarnas yttre skikt.

Enligt en utföringsform av uppfinningen är den fältstyrande kroppen elektriskt ansluten till minst ett av kablarnas inre skikt.

Enligt en annan utföringsform av uppfinningen är skärmen elektriskt ansluten till minst ett av kablarnas yttre skikt.

Den isolerande kroppen tar upp spänningsskillnaden mellan den fältstyrande kroppen och skärmen. Spänningsskillnaden mellan kablarna i öppet läge tas upp i kopplingsinrättningen, t.ex. i luftgap mellan rörliga kontaktparter eller av krafthalvledarkomponenter.

FIGURBESKRIVNING

Uppfinningen ska i det följande förklaras närmare under hänvisning till bifogade figurer, där

fig 1 visar ett första utföringsexempel av uppfinningen,

fig 2 visar ett andra utföringsexempel av uppfinningen, och

fig 3 visar ett tredje utföringsexempel av uppfinningen.

BESKRIVNING AV UTFÖRINGSEXEMPEL

Figur 1 visar ett första utföringsexempel av en elkopplare 1 enligt uppfinningen, där elkopplaren 1 är ansluten till en första fältinneslutande kabel 2 via en första skarvanordning 3, och en andra fältinneslutande kabel 4 via en andra

skarvanordning 5. Elkopplaren 1 är rotationssymmetrisk och visas i figur 1 i ett snitt längs sin axel. Kabeln 2 har en elektriskt ledare 6, ett inre halvledande skikt 7 omslutande ledaren 6, en elektriskt isolerande kabelkropp 8 omslutande det inre skiktet 7, och ett första yttre halvledande skikt 9 omslutande kabelkroppen 8. Den andra kabeln 4 har på samma sätt en elektriskt ledare 10, ett inre halvledande skikt 11 omslutande ledaren 10, en elektriskt isolerande kabelkropp 12 omslutande det inre skiktet 11 och ett yttre halvledande skikt 13 omslutande kabelkroppen 12. De yttre skikt 9 och 13 är anslutna till jord.

Elkopplaren 1 har en mekanisk kopplingsinrättning för att sluta och bryta en strömbana mellan kabeln 2 och kabeln 4. Kopplingsinrättningen innefattar en långsträckt kontaktpart 14 av ett magnetiskt material. Kontaktparten 14 är rörligt anordnad i en gasfylld kopplingskammare 15. Kontaktparten 14 är i elektrisk kontakt med ledaren 10 via en anslutning 16 i skarvanordningen 5. Kopplingsinrättningen har vidare en stationär kontaktpart 17 i elektrisk kontakt med ledaren 6, via en anslutning 18 i skarvanordningen 3. På elkopplarens 1 utsida är en första 19 och en andra 20 spole anordnad. Spolen 19 genererar vid en stängningssignal från en styr- och kontrollutrustning (ej visad) ett magnetfält i kopplingskammaren 15 på så sätt, att magnetiska krafter tvingar kontaktparten 14 till ett ändläge där den är i kontakt med kontaktparten 17 och elektriskt ansluter ledaren 6 med ledaren 10. Spolen 20 genererar vid en öppningssignal från styr- och kontrollutrustningen ett magnetfält i kopplingskammaren 15 på så sätt, att magnetiska krafter tvingar kontaktparten 14 till ett ändläge där den har en sådan position i förhållande till kontaktparten 17, att den elektriskt är isolerad från denna.

Elkopplaren 1 har en fältstyrande inrättning i form av ett inre halvledande skikt 21 som omsluter kopplingsinrättning. I sin ena ände ansluter skiktet 21, via ett inre halvledande anslutningsskikt 22 i skarvanordningen 3, till den första kabelns 2 inre halvledande skikt 7. I sin andra ände ansluter det halvledande skiktet 21, via ett inre halvledande anslutningsskikt 23 i den andra skarvanordningen 5, till den andra kabelns 4 inre halvlednade skikt 11. Skiktet 21 omsluter kontaktparten 17 och är i elektrisk kontakt med denna längs hela dess längd. Skiktet 21 omsluter också kontaktparten 14, men ansluter elektriskt till denna bara längs en del av dess längd, varefter skiktets 21 inre yta avviker från kontaktpartens 14 yta och bildar kopplingskammarens 15 radiella begränsningsyta.

Utanpå skiktet 21, och väl anslutande till detta, är anordnad en elektriskt isolerande kropp 24 som omsluter skiktet 21 längs huvudsakligen hela dess längd. Kroppens 24 ändar ansluter till elektriskt isolerande kroppar 25 och 26 i skarvenheterna 3 och 5.

Elkopplaren 1 har vidare en utanpå kroppen 24 anordnad skärm i form av ett halvledande skikt 27 som i sin ena ände, via ett halvledande anslutningsskikt 28 i den första skarvanordningen 3, ansluter till den första ledarens 2 yttre halvledande skikt 9. I sin andra ände ansluter skiktet 27, via ett andra halvledande anslutningsskikt 29 i den andra skarvanordningen 5, till den andra ledarens 4 yttre halvlednade skikt 13.

Skikten 7, 22, 21, 23 och 11 bildar tillsammans ett kontinuerligt inre halvledande skikt som omsluter elkopplarens 1 och kablarnas 2 och 4 alla strömförande parter. Omslutande detta kontinuerliga skikt bildar kropparna 8, 25, 24, 26 och 13 en kontinuerlig elektriskt isolerande kropp, och omslutande denna

kontinuerliga kropp bildar skikten 9, 28, 27, 29 och 13 ett kontinuerligt yttre halvledande skikt.

Då elkopplaren 1 är sluten fungerar skiktet 21 som en förlängning av kablarnas inre skikt 7 och 11. På samma sätt fungerar kroppen 24 som en förlängning av kabelkropparna 8 och 12, och skiktet 27 som en förlängning av skikten 9 och 13. Företrädesvis är skikten 9, 28, 27, 29 och 13 anslutna till jord varigenom ett helt fältinneslutande arrangemang erhålls.

Då elkopplaren 1 öppnas uppstår en spänningsskillnad mellan ledaren 6 och ledaren 10. Kontaktpartens 14 ändlägen måste därvid vara så separerade, att inget överslag sker genom kopplingskammaren 15. Längs skiktet 21 mellan kontaktparterna 14 och 17 uppstår då elkopplaren 1 öppnas, en spänningsgradient. Skiktet 21 måste därvid dimensioneras för att klara denna gradient.

I figur 2 visas ett andra utföringsexempel av elkopplaren enligt uppfinningen. En fältstyrande inrättning i form av en ledande cylinder 31 omsluter i huvudsak kopplingsinrättning i stället för det i figur 1 visade halvledande skiktet 21. Cylindern har ingen förmåga att då elkoppleran är öppen uppta en spänningsgradient i sin längdriktning, varför cylindern ej ansluter till den stationära kontaktparten 17. Ett mellanrum 32 som upptas av den isolerande kroppen 24 separerar kontaktparten 17 och cylindern 31.

I figur 3 och 4 visas ett tredje utföringsexempel av elkopplaren enligt uppfinningen i form av en omkopplare. Omkopplaren kan via ett första anslutningsuttag 41 ansluta en första kabel (ej visad) med antingen en andra kabel (ej visad) via ett andra anslutningsuttag 42, eller till en tredje kabel (ej visad) via ett tredje anslutningsuttag 43. Omkopplaren har en kopplingsinrättning i form av en rörlig kontaktpart 44 som via en isolerad dragstång 45 är manövrerbar med ett manöverdon

46. Kopplingsinrättningen kan sluta eller bryta en strömbana mellan den första kabeln och den andra kabel, eller mellan den första kabeln och den tredje kabeln. Kopplingsinrättningen är i huvudsak omsluten av en fältstyrande inrättning i form av tre ledande fältstyrande kroppar 47, 48, och 49. De fältstyrande kropparna är i elektrisk kontakt med var sin kabel via anslutningsledarna 50, 51, 52. Omslutande den fältstyrande inrättning finns en elektriskt isolerande kropp 24, och omslutande kroppen 24 finns en skärm i form av ett metallhölje 53. De fältstyrande kropparna 47, 48, och 49 bildar en fortsättning på kablarnas inre halvledande skikt, den isolerande kroppen 24 bildar en fortsättning på kablarnas kabelkroppar och metallhöljet 53 bildar en fortsättning på kablarnas yttre halvledande skikt.

PATENTKRAV

1. Elkopplare (1) innefattande en kopplingsinrättning för att sluta eller bryta en strömbana mellan en första kabel (2) och minst en andra kabel (3), vilka kablar har en elektrisk ledare (6, 10), ett inre halvledande skikt (7, 11) omslutande ledaren, en elektriskt isolerande fast kabelkropp (8, 12) omslutande det inre skiktet och ett yttre halvledande skikt (9, 13) omslutande kabelkroppen,
**kännetecknad av** att elkopplaren innefattar:
- en fältstyrande inrättning omslutande kopplingsinrättningen innefattande minst en ledande eller halvledande fältstyrande kropp (21, 31, 47, 48, 49) ansluten till en första potential,
- en elektriskt isolerande fast kropp (24) omslutande den fältstyrande inrättningen,
- en ledande eller halvledande skärm (27, 53) omslutande den isolerande fasta kroppen (24) ansluten till en andra potential, och
- minst två kontaktparter (14, 17, 40,) rörligt anordnade i förhållande till varandra, där den ena kontaktparten är elektriskt ansluten till den första kabelns (6) ledare och den andra kontaktparten är elektriskt ansluten till den andra kabelns (10) ledare.

2. Elkopplare kopplingsanordning enligt krav 1,
**kännetecknad av** att kontaktparterna är manövrerbara med ett manöverdon mellan ett slutet läge och ett öppet läge.

3. Elkopplare enligt krav 1 eller 2,
**kännetecknad av** att kopplingsinrättningen innefattar halvledare som sluter eller öppnar strömbanan vid styrning av ledningsförmågan hos halvledarna.

4. Elkopplare enligt något av ovanstående krav, **kännetecknad av** att den fältstyrande kroppen (21, 31, 47, 48, 49) är elektriskt ansluten till något av kablarnas (2, 4) inre halvledande skikt (7, 11).

5. Elkopplare enligt något av ovanstående krav, **kännetecknad av** att skärmen (27, 53) är elektriskt ansluten till minst en av kablarnas (2, 4) yttre halvledande skikt (9, 13).

6. Elkopplare enligt något av ovanstående krav, **kännetecknad av** att skärmen (27, 53) är elektriskt ansluten till jord.

7. Elkopplare enligt något av ovanstående krav, **kännetecknad av** att en första och en andra spole är anordnade vid utsidan av elkopplaren och generar ett magnetfält i kopplingskammaren som tvingar kontaktparterna till ett förutbestämt läge.

8. Elkopplare enligt något av krav 1 till 5, **kännetecknad av** att den rörliga kontaktparten (44) är manövrerbar via en isolerad dragstång 45.

SAMMANDRAG

Uppfinningen avser en elkopplare (1) innefattande en kopplingsinrättning med två rörligt till varandra anordnade kontaktparter för att sluta eller bryta en strömbana mellan två kablar med en elektrisk ledare (6, 10), ett inre halvledande skikt (7, 11) omslutande ledaren, en elektriskt isolerande fast kabelkropp (8, 12) omslutande det inre skiktet och ett yttre halvledande skikt (9, 13) omslutande kabelkroppen. Elkopplaren innefattar en fältstyrande inrättning omslutande kopplingsinrättningen innefattande minst en ledande eller halvledande fältstyrande kropp (21) ansluten till en första potential, en elektriskt isolerande fast kropp (24) omslutande den fältstyrande inrättningen, och en ledande eller halvledande skärm (27) omslutande den isolerande fasta kroppen (24) ansluten till en andra potential. Enligt en utföringsform av uppfinningen är den fältstyrande kroppen (21) elektriskt ansluten till minst ett av kablarnas inre halvledande skikt (7, 11). Enligt en annan utföringsform av uppfinningen är skärmen (27) elektriskt ansluten till minst ett av kablarnas yttre halvledande skikt (9, 13).

(Figur 1)

The switching device 1 has a field-controlling means in the form of an inner semiconductive layer 21 which surrounds the switching means. At one end, the layer 21 makes contact, via an inner semiconductive connecting layer 22 in the joint means 3, with the inner semiconductive layer 7 of the first cable 2. At its other end, the semiconductive layer 21 makes contact, via an inner semiconductive connecting layer 23 in the second joint means 5, with the inner semiconductive layer 11 of the second cable 4. The layer 21 surrounds the contact member 17 and is in electrical contact therewith along the whole of its length. The layer 21 also surrounds the contact member 14 but is electrically connected thereto along part of its length only, whereupon the inner surface of the layer 21 deviates from the surface of the contact member 14 and forms the radial limiting surface of the switching chamber 15.

Outside the layer 21, and making good contact therewith, an electrically insulating body 24 is arranged, which surrounds the layer 21 along substantially the whole of its length. The ends of the body 24 make contact with electrically insulating bodies 25 and 26 in the joint units 3 and 5.

Further, the switching device 1 has a shield, arranged outside the body 24, in the form of a semiconductive layer 27 which at one end, via a semiconductive connecting layer 28 in the first joint means 3, makes contact with the outer semiconductive layer 9 of the first conductor 2. At its other end, the layer 27 makes contact, via a second semiconductive connecting layer 29 in the second joint means 5, with the outer semiconductive layer 13 of the second conductor 4.

The layers 7, 22, 21, 23 and 11 together form a continuous inner semiconductive layer which surrounds all the current-carrying members of the switching device 1 and the cables 2 and 4. Surrounding this continuous layer, the bodies 8, 25, 24, 26 and 12 form a continuous electrically insulating body, and surrounding this continuous body, the layers 9,

REPLACED BY ART 34 AMDT

cables, and the shield corresponds to the outer layers of the cables.

The field-controlling body preferably has a potential which essentially corresponds to the potential of the cable conductors, and the shield preferably has a potential which essentially corresponds to the potential of the outer layer of the cables.

According to one preferred embodiment of the invention, the field-controlling body is electrically connected to at least one of the inner layers of the cables.

According to another embodiment of the invention, the shield is electrically connected to at least one of the outer layers of the cables.

The insulating body assumes the voltage difference between the field-controlling body and the shield. The voltage difference between the cables in the open position is assumed in the switching means, for example in air gaps between movable contact members or by power semiconductor devices.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be explained in greater detail with reference to the accompanying drawings, wherein

Figure 1 shows a first embodiment of the invention,

Figure 2 shows a second embodiment of the invention, and

Figures 3 and 4 show a third embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a first embodiment of a switching device 1 according to the invention, wherein the switching device 1

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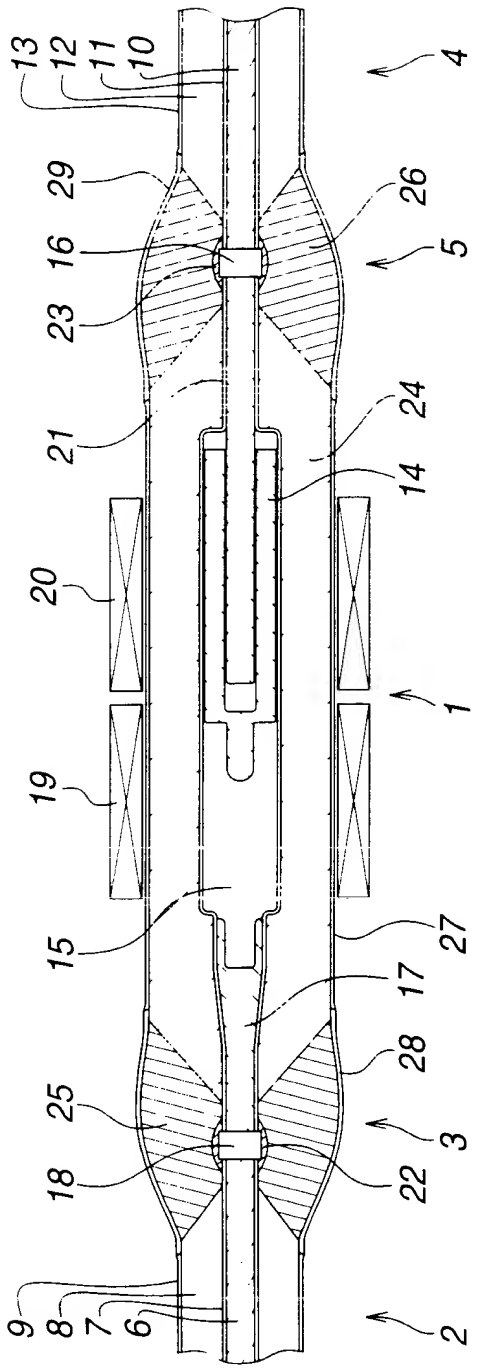


Fig. 1

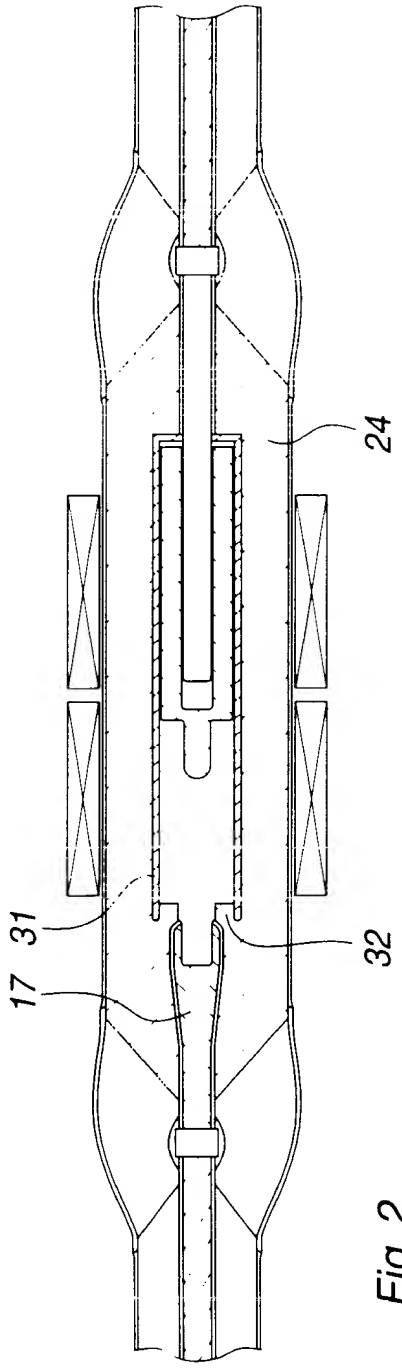


Fig. 2

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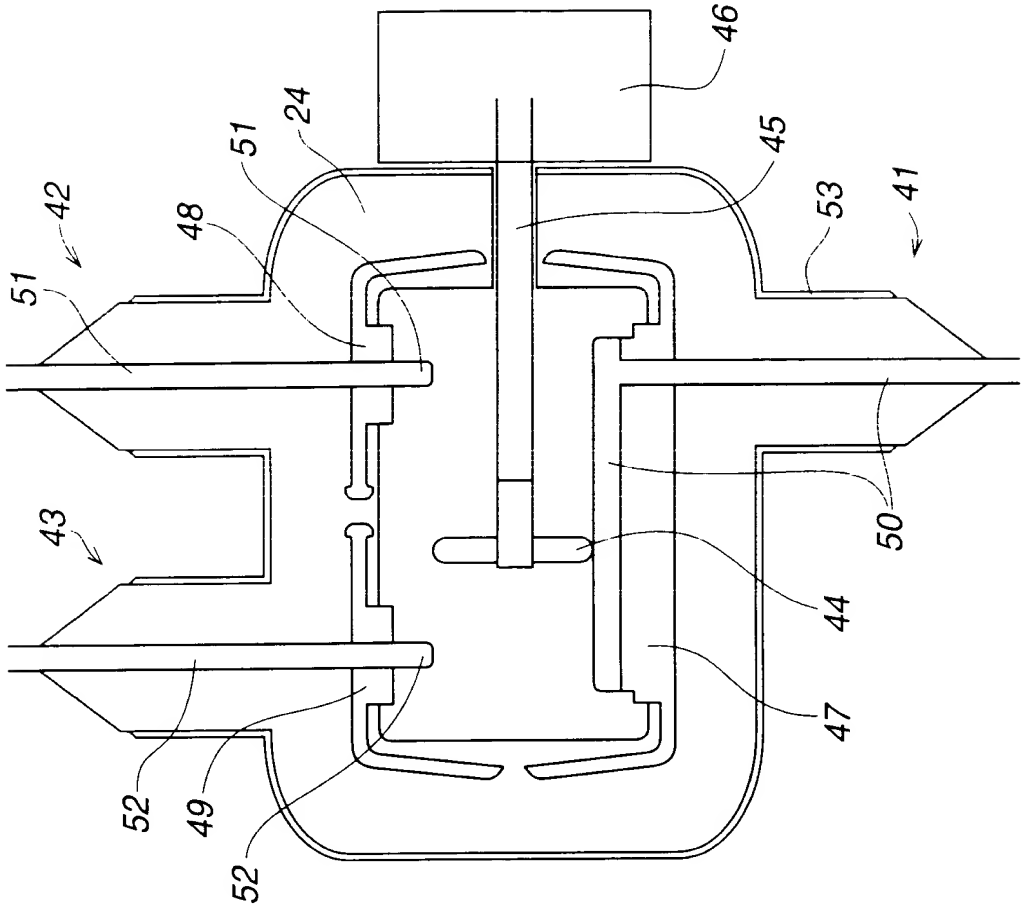


Fig. 4

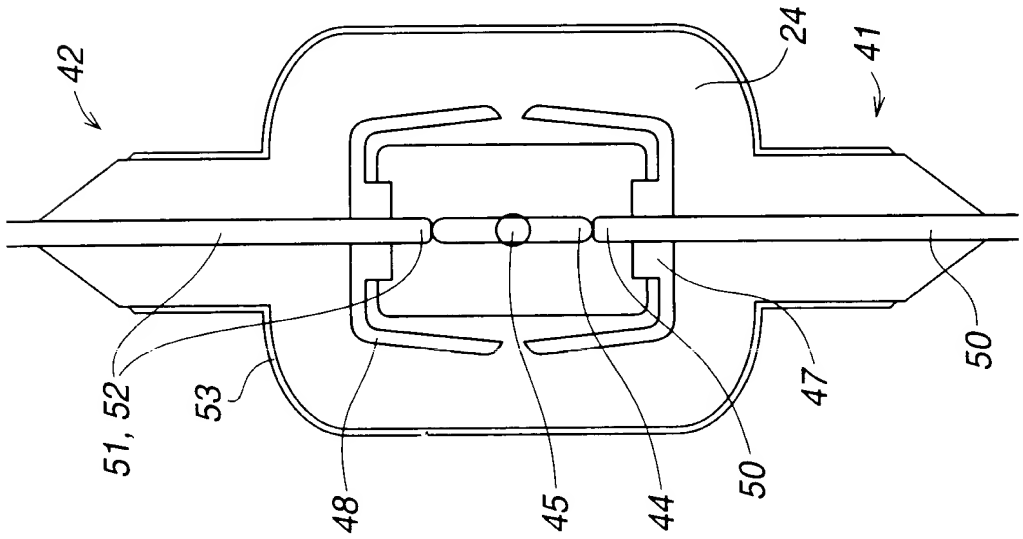


Fig. 3

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01099

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H01H 33/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H01B, H01H, H02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | DE 19719739 A1 (KAISER KABEL GMBH), 12 November 1998 (12.11.98), column 5, line 59 - column 6, line 41, figures 5,6 | 1-8 |
| A | GB 2125637 A (RAYCHEM CORPORATION), 7 March 1984 (07.03.84), page 4, line 90 - line 130, figure 3 | 1-8 |
| A | US 3559141 A (S.G. HARDY), 26 January 1971 (26.01.71), column 3, line 31 - column 5, line 16, figure 1 | 1-8 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 30 August 2000 | 07 -09- 2000 |
| Name and mailing address of the ISA<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. + 46 8 666 02 86 | Authorized officer<br>Bertil Nordenberg/MN<br>Telephone No. + 46 8 782 25 00 |

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Information on patent family members

08/05/00

International application No.
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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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